US009055418B2

(12) **United States Patent**
Cho et al.

(10) **Patent No.: US 9,055,418 B2**
(45) **Date of Patent: Jun. 9, 2015**

(54) **METHOD AND SYSTEM FOR DELIVERING SMS (SHORT MESSAGE SERVICE) MESSAGES IN A MOBILE COMMUNICATION SYSTEM**

(75) Inventors: **Song-yean Cho**, Seoul (KR); **Soeng-Hun Kim**, Suwon-si (KR); **Sung-Ho Choi**, Suwon-si (KR); **Beom-Sik Bae**, Suwon-si (KR)

(73) Assignee: **Samsung Electronics Co., Ltd.**, Suwon-si (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 168 days.

(21) Appl. No.: **13/695,759**

(22) PCT Filed: **Apr. 29, 2011**

(86) PCT No.: **PCT/KR2011/003244**

§ 371 (c)(1),
(2), (4) Date: **Nov. 1, 2012**

(87) PCT Pub. No.: **WO2011/139056**

PCT Pub. Date: **Nov. 10, 2011**

(65) **Prior Publication Data**

US 2013/0095796 A1 Apr. 18, 2013

(30) **Foreign Application Priority Data**

May 3, 2010 (KR) 10-2010-0041602

(51) **Int. Cl.**
H04W 4/00 (2009.01)
H04W 4/14 (2009.01)
(Continued)

(52) **U.S. Cl.**
CPC ***H04W 4/14*** (2013.01); *H04W 88/08* (2013.01); ***H04W 72/0406*** (2013.01); *H04L 63/162* (2013.01); ***H04W 12/02*** (2013.01)

(58) **Field of Classification Search**
CPC H04W 8/16; H04W 8/24; H04W 12/00; H04W 12/02; H04W 12/04; H04W 12/08; H04W 48/02
USPC 455/411, 432.1, 432.3, 433, 435.1, 455/435.2, 561, 436, 434, 450; 370/329
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

8,588,745 B2 * 11/2013 Gupta et al. 455/411
2009/0052388 A1 * 2/2009 Kim et al. 370/329
(Continued)

FOREIGN PATENT DOCUMENTS

CN 101669377 A 3/2010
KR 10-2010-0021384 A 2/2010
(Continued)

OTHER PUBLICATIONS

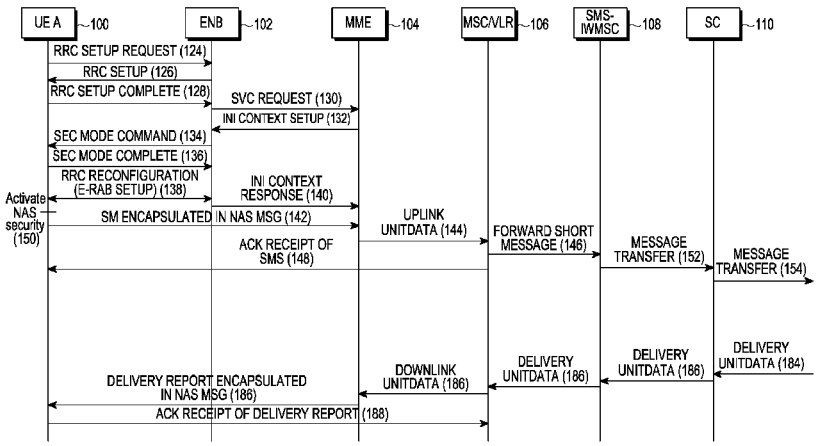
NEC, UE-EPC Signalling Setup: S1AP corrections, 3GPP TSG-RAN WG3 # 61 bis, R3-082691, XP050323959, Sep. 24, 2008, pp. 2, 4, Prague, Czech Republic.
(Continued)

Primary Examiner — Amancio Gonzalez
(74) *Attorney, Agent, or Firm* — Jefferson IP Law, LLP

(57) **ABSTRACT**

A method and system for delivering data are provided. The method includes sending, by a User Equipment (UE), to an evolved Node-B (eNB) a service request message for requesting data when setting up Radio Resource Control (RRC) connection using a RRC connection complete message, sending, by the eNB, the received service request message to a Mobile Management Entity (MME) using an initial UE message, sending, by the MME, an 'initial context setup for signaling' message that does not include information about data bearers, to the eNB, upon receiving the initial context setup message, setting up, by the eNB, Access Stratum (AS) security with the originating UE and performing, by the originating UE, Non Access Stratum (NAS) security with the MME, and upon completion of the NAS security process with the MME, transmitting, by the originating UE, the data to the MME using an uplink NAS transport message.

10 Claims, 14 Drawing Sheets



(51) **Int. Cl.**

H04W 72/04	(2009.01)
H04W 12/02	(2009.01)
H04W 88/08	(2009.01)
H04L 29/06	(2006.01)

(56) **References Cited**

U.S. PATENT DOCUMENTS

2011/0105119	A1*	5/2011	Bienas et al.	455/436
2012/0033565	A1	2/2012	Suh et al.	

FOREIGN PATENT DOCUMENTS

KR	10-2010-0021690	A	2/2010
KR	10-2010-0038563	A	4/2010
WO	2010/018801	A1	2/2010
WO	2010/025280	A2	3/2010

OTHER PUBLICATIONS

3rd Generation Partnership Project; Technical Specification Group Core Network and Terminals; Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3 (Release 8), 3GPP TS 24.301, V8.5.0, XP050402198, Mar. 31, 2010, sections 4.4.4.1, 8.2.25, Sophia-Antipolis, France.

* cited by examiner

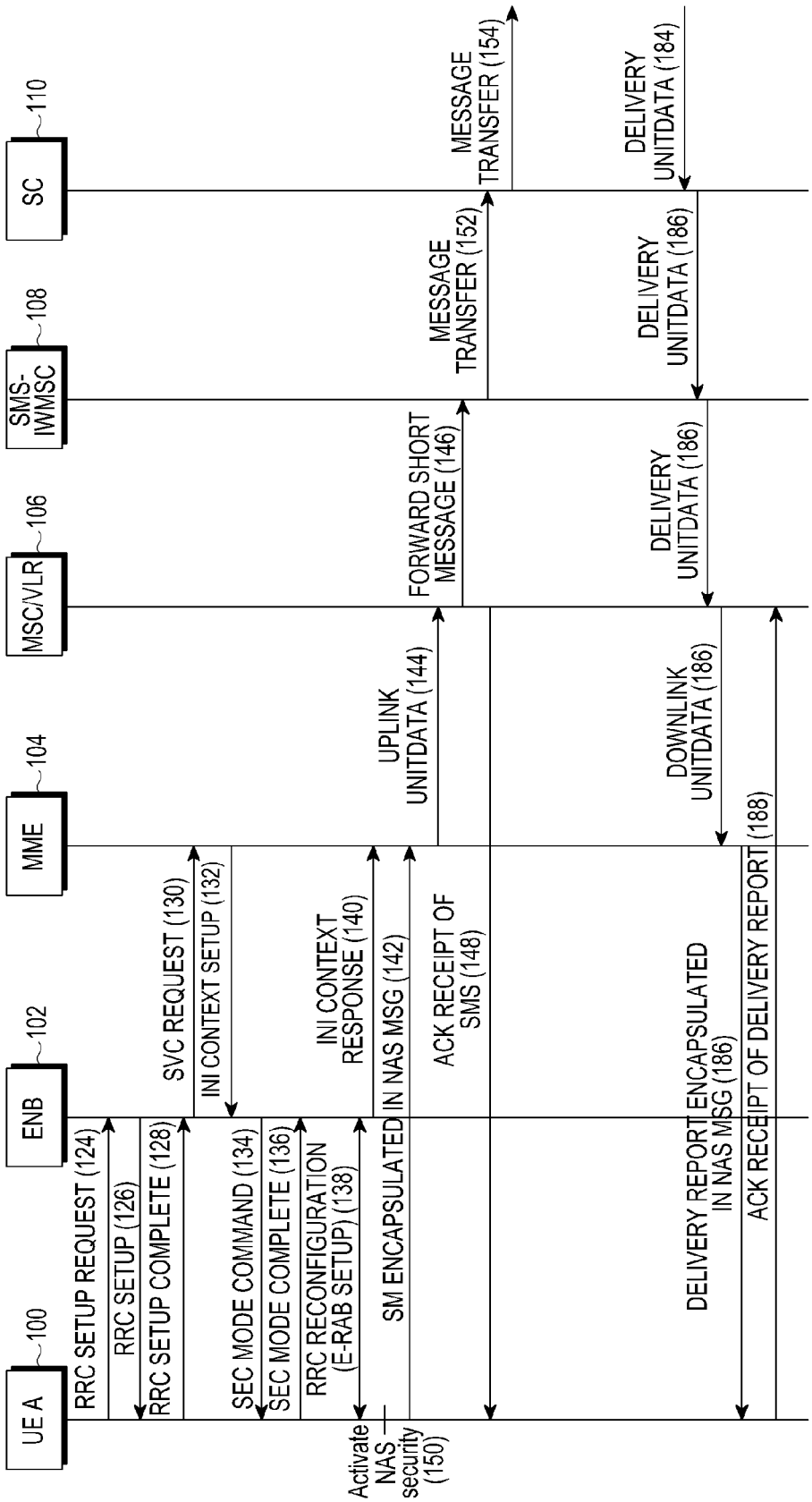

UE A
100
ENB
102
MME
104
MSC/VLR
106
SMS-IWMSC
108
SC
110
RRC SETUP REQUEST (124)
RRC SETUP (126)
RRC SETUP COMPLETE (128)
SVC REQUEST (130)
INI CONTEXT SETUP (132)
SEC MODE COMMAND (134)
SEC MODE COMPLETE (136)
RRC RECONFIGURATION (E-RAB SETUP) (138)
INI CONTEXT RESPONSE (140)
SM ENCAPSULATED IN NAS MSG (142)
UPLINK UNITDATA (144)
FORWARD SHORT MESSAGE (146)
MESSAGE TRANSFER (152)
MESSAGE TRANSFER (154)
ACK RECEIPT OF SMS (148)
DELIVERY UNITDATA (186)
DELIVERY UNITDATA (186)
DELIVERY UNITDATA (184)
DOWNLINK UNITDATA (186)
DELIVERY REPORT ENCAPSULATED IN NAS MSG (186)
ACK RECEIPT OF DELIVERY REPORT (188)
Activate NAS security (150)

FIG. 1A

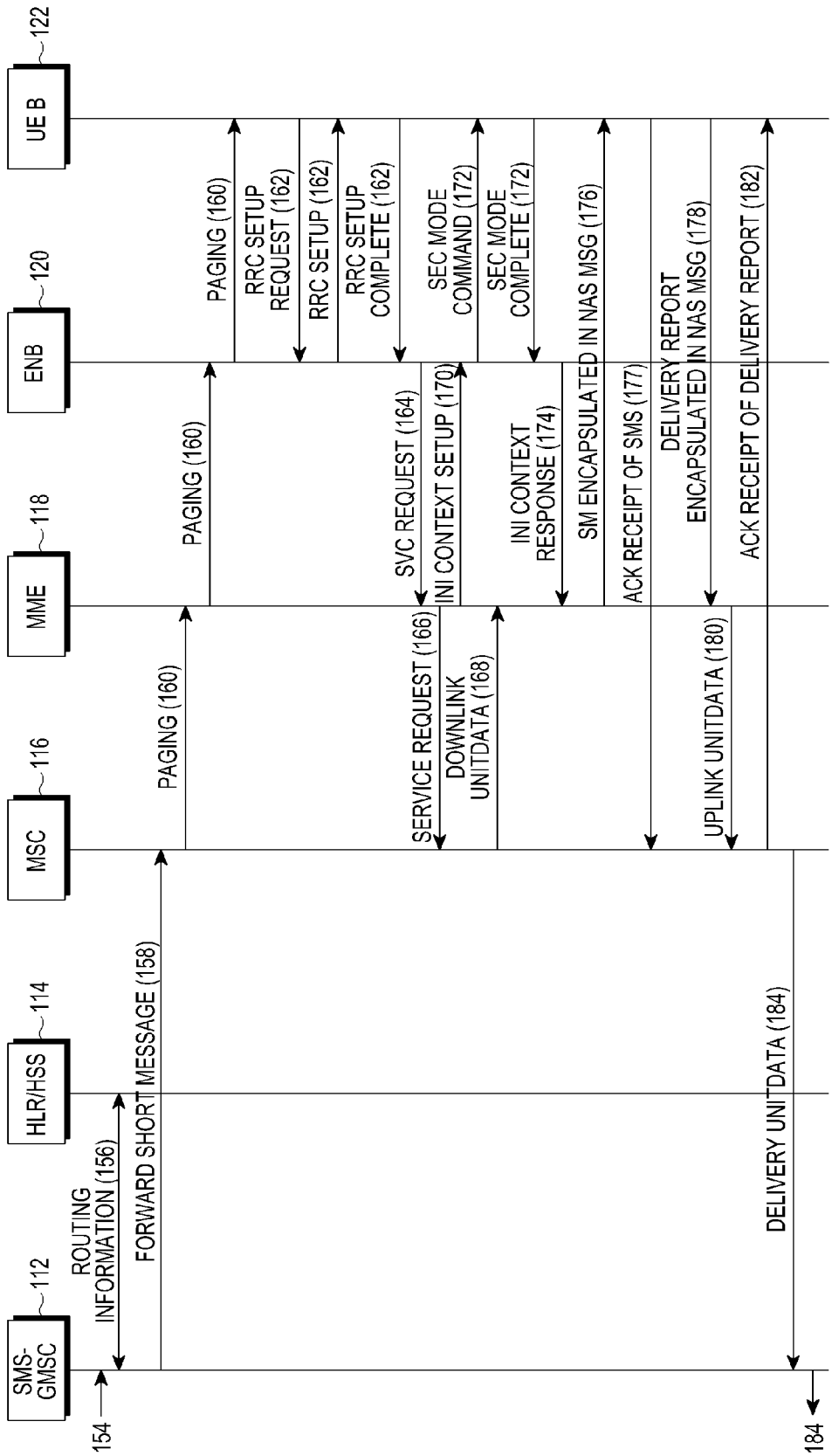

SMS-GMSC
112
HLR/HSS
114
MSC
116
MME
118
ENB
120
UE B
122
154
184
ROUTING INFORMATION (156)
FORWARD SHORT MESSAGE (158)
PAGING (160)
PAGING (160)
PAGING (160)
RRC SETUP REQUEST (162)
RRC SETUP (162)
RRC SETUP COMPLETE (162)
SERVICE REQUEST (166)
DOWNLINK UNITDATA (168)
SVC REQUEST (164)
INI CONTEXT SETUP (170)
SEC MODE COMMAND (172)
SEC MODE COMPLETE (172)
INI CONTEXT RESPONSE (174)
SM ENCAPSULATED IN NAS MSG (176)
ACK RECEIPT OF SMS (177)
DELIVERY REPORT ENCAPSULATED IN NAS MSG (178)
UPLINK UNITDATA (180)
ACK RECEIPT OF DELIVERY REPORT (182)
DELIVERY UNITDATA (184)

FIG. 1B

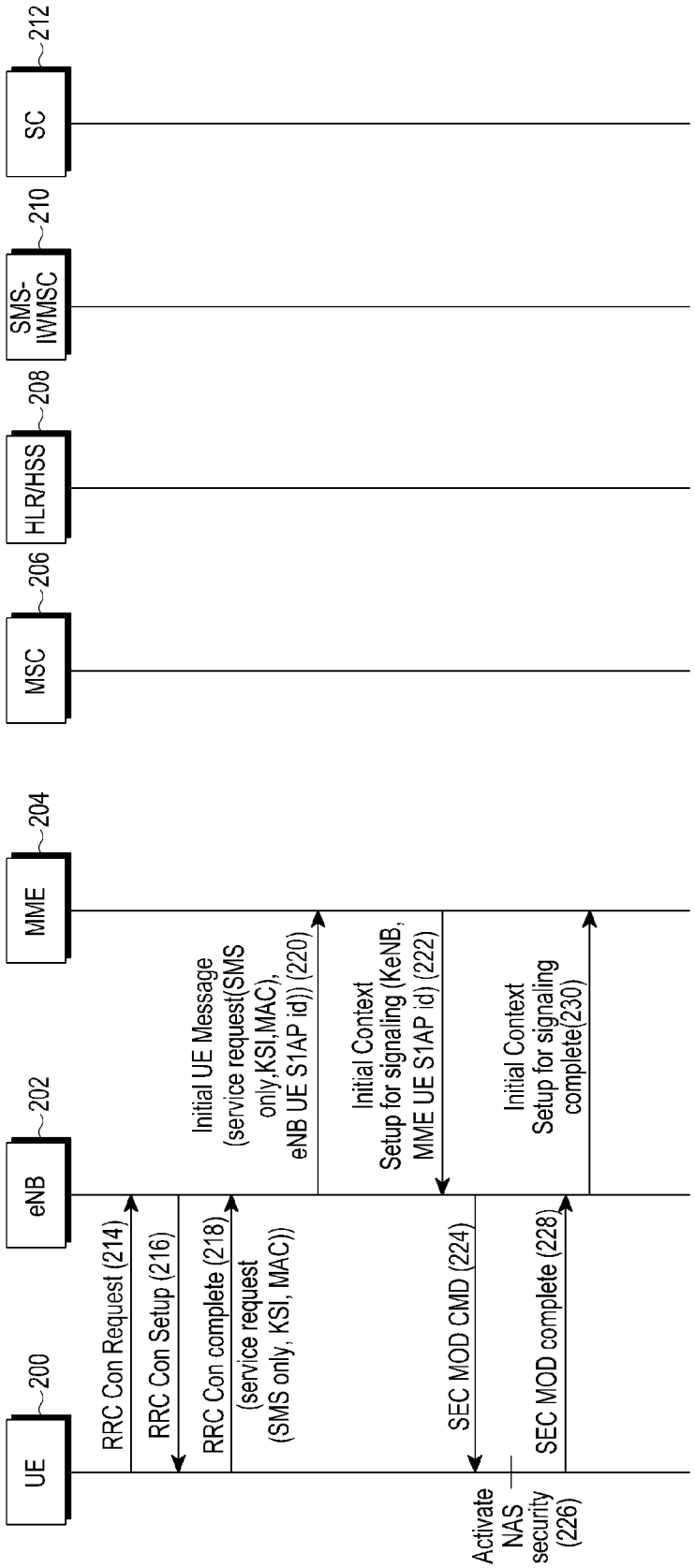

UE
200
eNB
202
MME
204
MSC
206
HLR/HSS
208
SMS-IWMSC
210
SC
212
RRC Con Request (214)
RRC Con Setup (216)
RRC Con complete (218)
(service request (SMS only, KSI, MAC))
Initial UE Message (service request(SMS only,KSI,MAC), eNB UE S1AP id)) (220)
Initial Context Setup for signaling (KeNB, MME UE S1AP id) (222)
SEC MOD CMD (224)
Activate NAS security (226)
SEC MOD complete (228)
Initial Context Setup for signaling complete(230)

FIG.2A

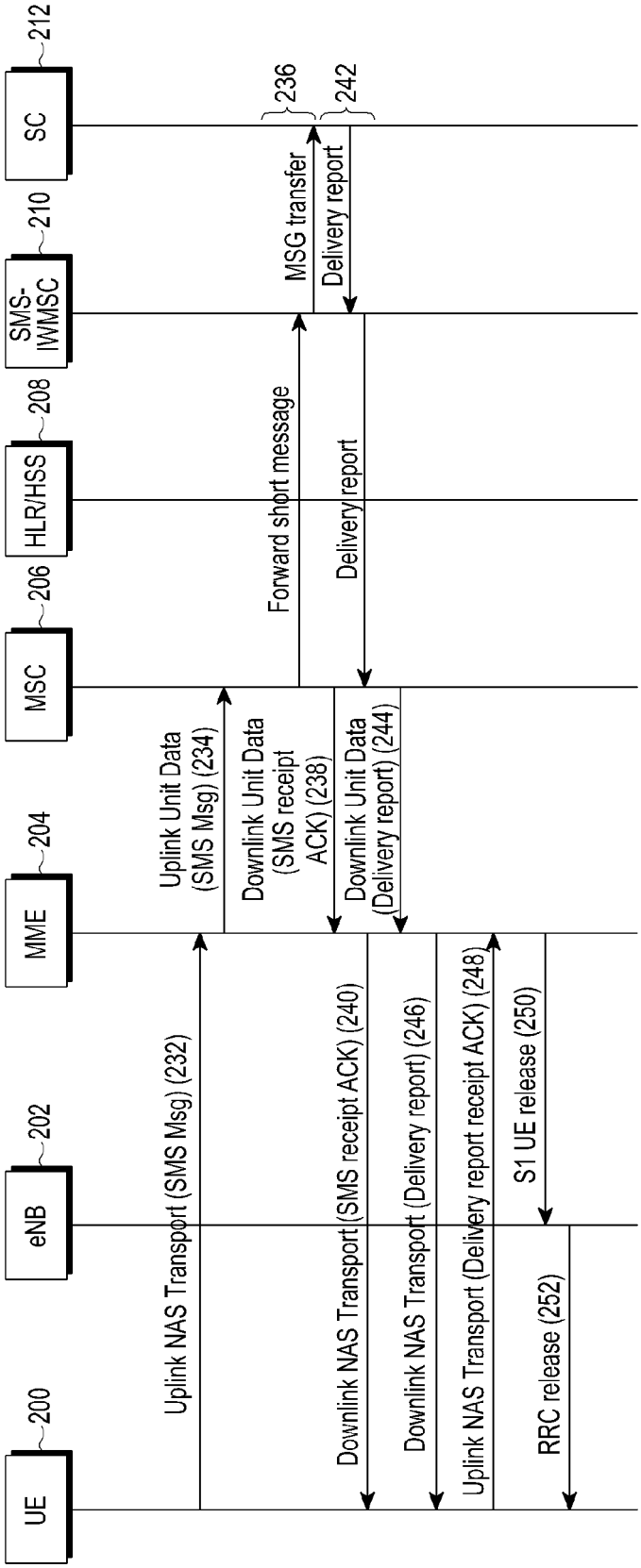

UE
200
eNB
202
MME
204
MSC
206
HLR/HSS
208
SMS-IWMSC
210
SC
212
236
242
Uplink NAS Transport (SMS Msg) (232)
Uplink Unit Data (SMS Msg) (234)
Forward short message
MSG transfer
Delivery report
Downlink Unit Data (SMS receipt ACK) (238)
Delivery report
Downlink Unit Data (Delivery report) (244)
Downlink NAS Transport (SMS receipt ACK) (240)
Downlink NAS Transport (Delivery report) (246)
Uplink NAS Transport (Delivery report receipt ACK) (248)
S1 UE release (250)
RRC release (252)

FIG.2B

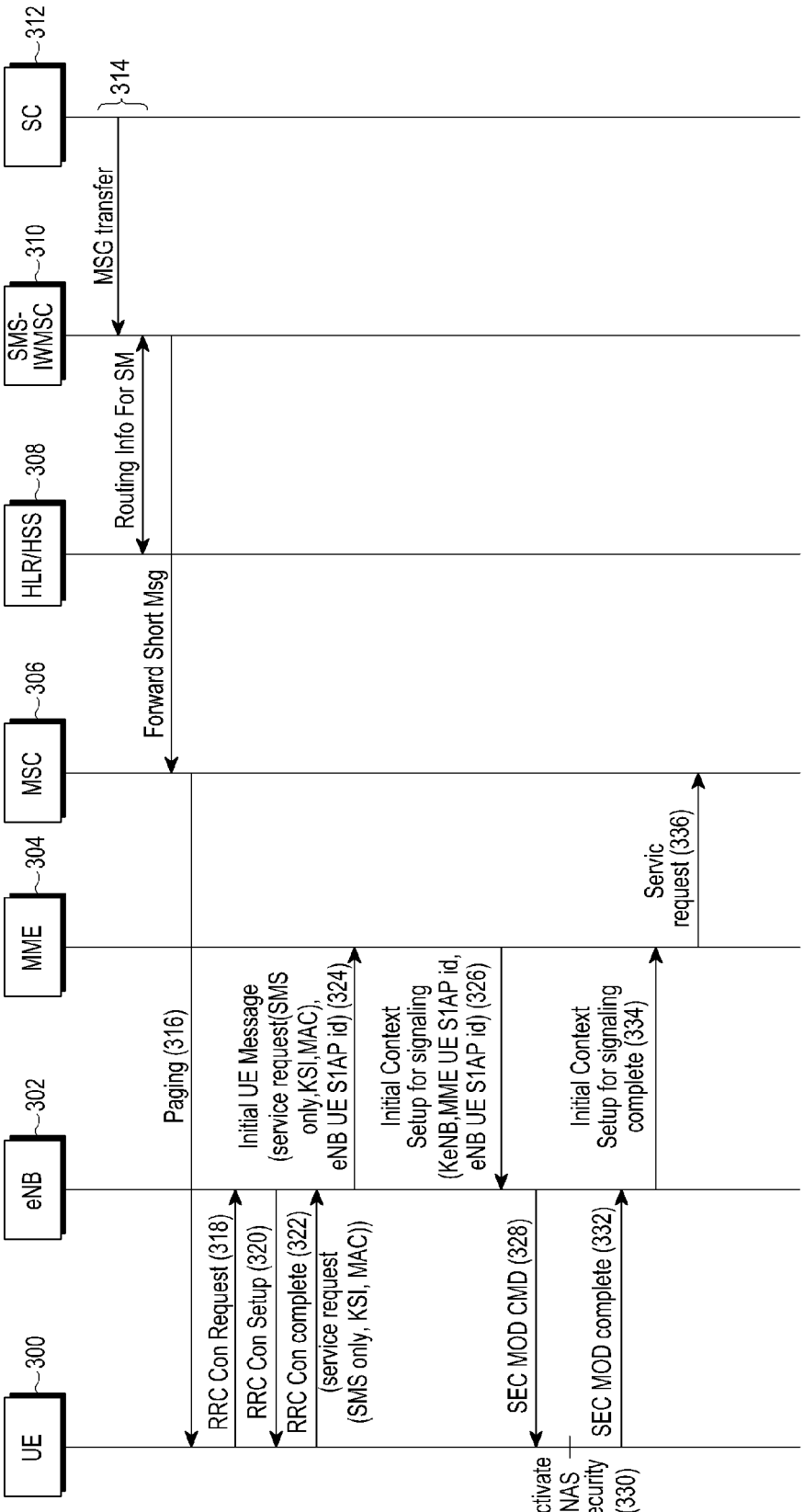

UE
300
eNB
302
MME
304
MSC
306
HLR/HSS
308
SMS-IWMSC
310
SC
312
314
MSG transfer
Routing Info For SM
Forward Short Msg
Paging (316)
RRC Con Request (318)
RRC Con Setup (320)
RRC Con complete (322)
(service request (SMS only, KSI, MAC))
Initial UE Message (service request(SMS only,KSI,MAC), eNB UE S1AP id) (324)
Initial Context Setup for signaling (KeNB,MME UE S1AP id, eNB UE S1AP id) (326)
SEC MOD CMD (328)
SEC MOD complete (332)
Initial Context Setup for signaling complete (334)
Servic request (336)
Activate NAS security (330)

FIG.3A

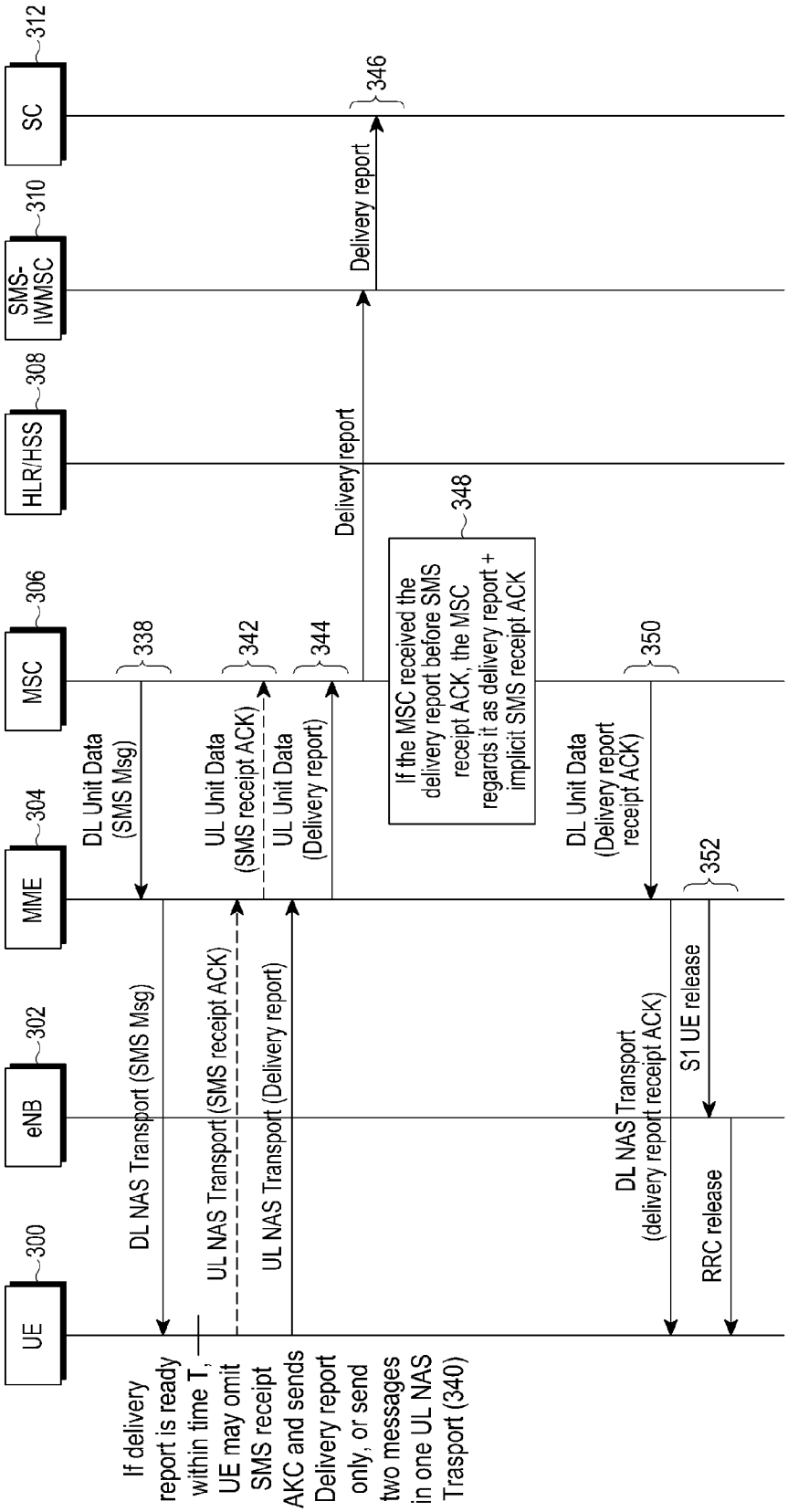

UE
300
eNB
302
MME
304
MSC
306
HLR/HSS
308
SMS-IWMSC
310
SC
312
If delivery report is ready within time T, UE may omit SMS receipt AKC and sends Delivery report only, or send two messages in one UL NAS Trasport (340)
DL NAS Transport (SMS Msg)
DL Unit Data (SMS Msg)
338
UL NAS Transport (SMS receipt ACK)
UL Unit Data (SMS receipt ACK)
342
UL NAS Transport (Delivery report)
UL Unit Data (Delivery report)
344
Delivery report
Delivery report
346
If the MSC received the delivery report before SMS receipt ACK, the MSC regards it as delivery report + implicit SMS receipt ACK
348
DL Unit Data (Delivery report receipt ACK)
350
DL NAS Transport (delivery report receipt ACK)
S1 UE release
352
RRC release

FIG.3B

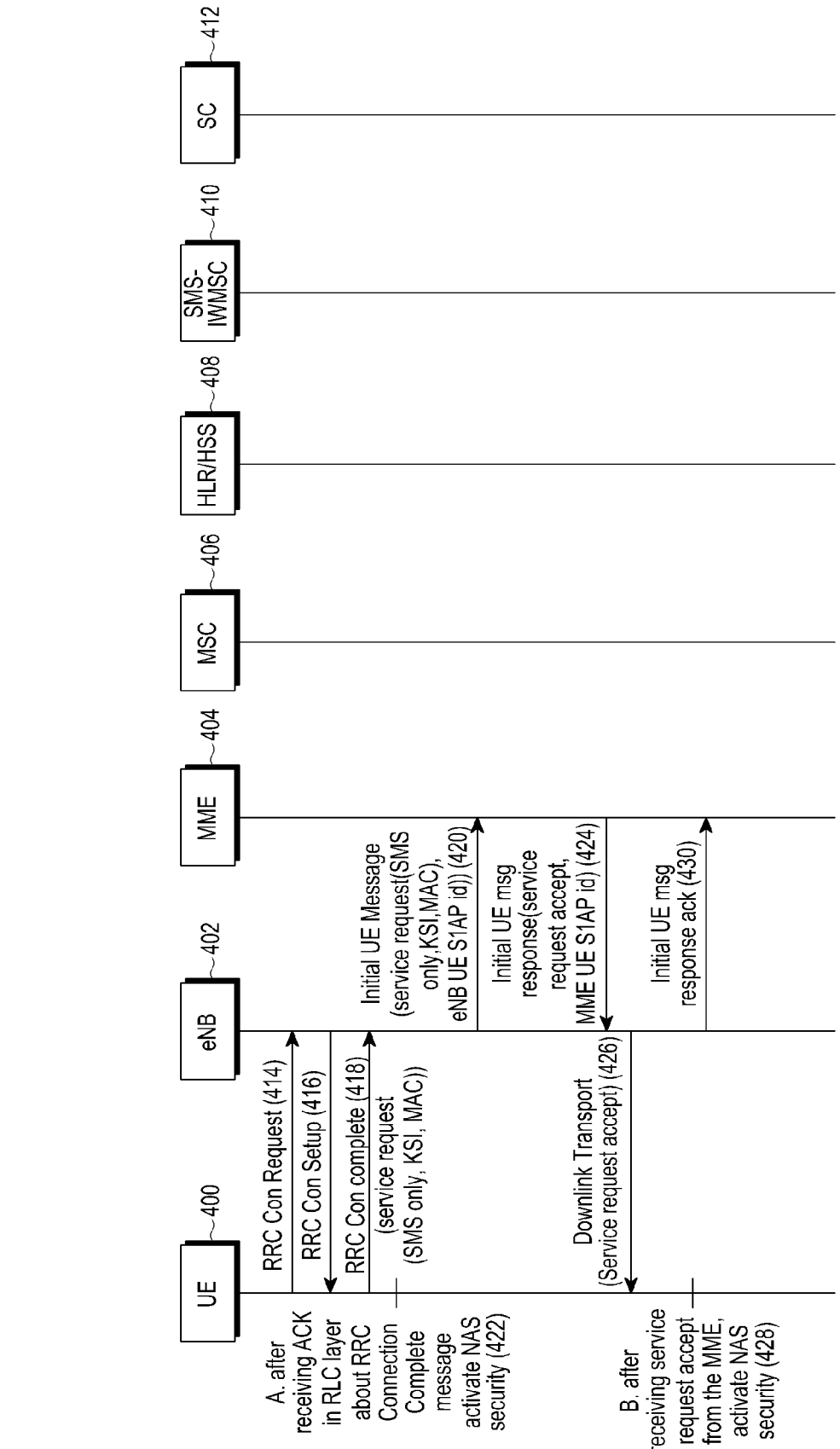

UE
400
eNB
402
MME
404
MSC
406
HLR/HSS
408
SMS-IWMSC
410
SC
412
RRC Con Request (414)
RRC Con Setup (416)
RRC Con complete (418)
(service request (SMS only, KSI, MAC))
Initial UE Message (service request(SMS only,KSI,MAC), eNB UE S1AP id)) (420)
Initial UE msg response(service request accept, MME UE S1AP id) (424)
Initial UE msg response ack (430)
Downlink Transport (Service request accept) (426)
A. after receiving ACK in RLC layer about RRC Connection Complete message activate NAS security (422)
B. after receiving service request accept from the MME, activate NAS security (428)

FIG. 4A

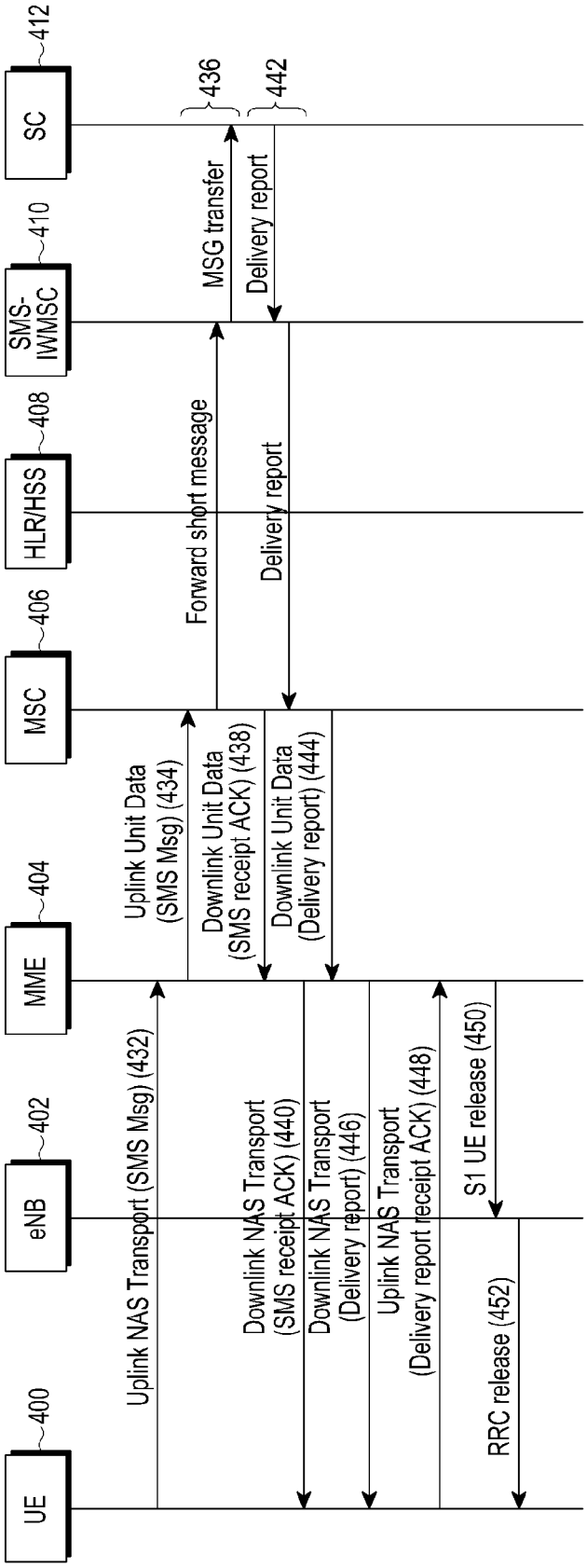

UE
400
eNB
402
MME
404
MSC
406
HLR/HSS
408
SMS-IWMSC
410
SC
412
436
442
Uplink NAS Transport (SMS Msg) (432)
Uplink Unit Data (SMS Msg) (434)
Downlink Unit Data (SMS receipt ACK) (438)
Downlink Unit Data (Delivery report) (444)
Forward short message
Delivery report
MSG transfer
Delivery report
Downlink NAS Transport (SMS receipt ACK) (440)
Downlink NAS Transport (Delivery report) (446)
Uplink NAS Transport (Delivery report receipt ACK) (448)
S1 UE release (450)
RRC release (452)

FIG. 4B

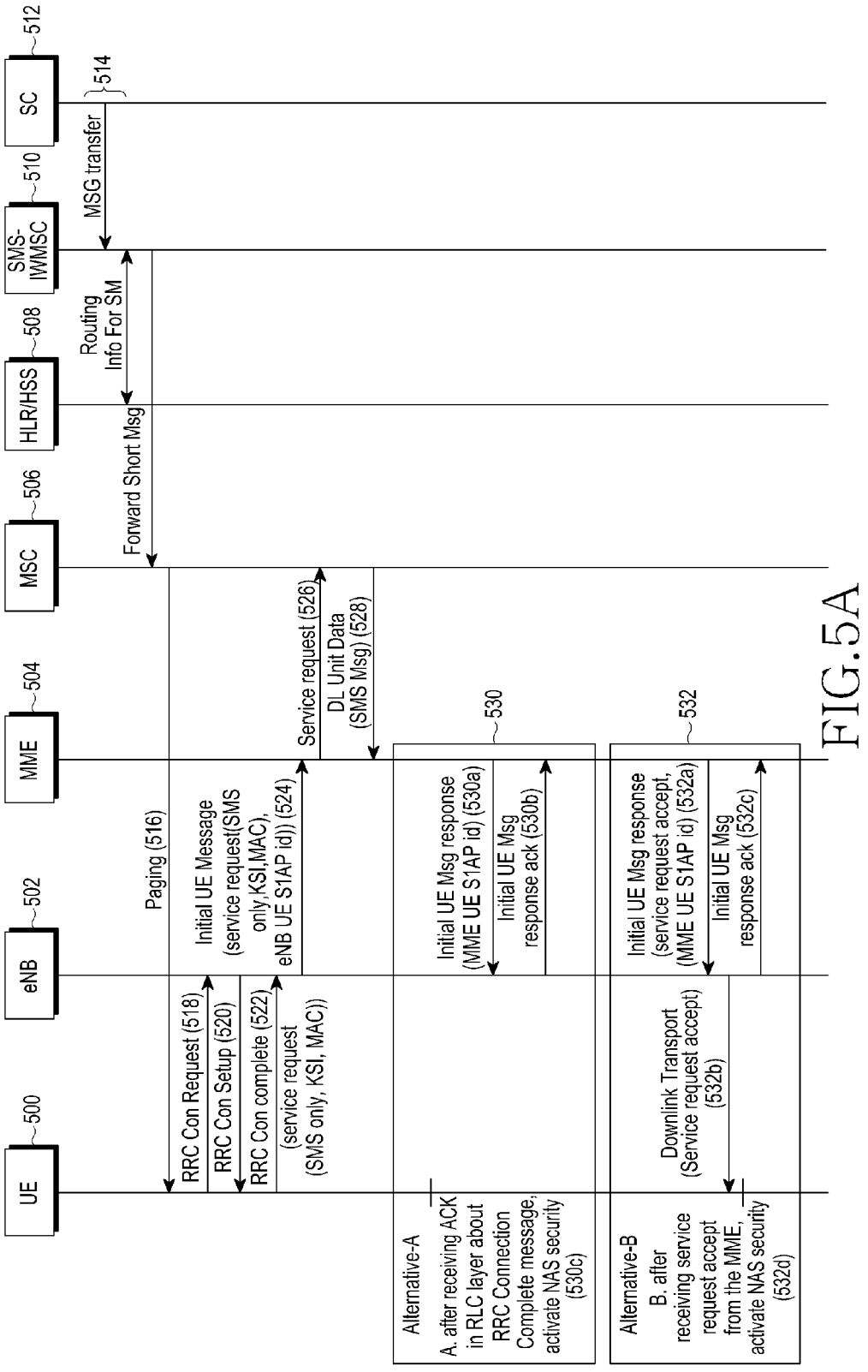

UE
500
eNB
502
MME
504
MSC
506
HLR/HSS
508
SMS-IWMSC
510
SC
512
514
MSG transfer
Routing Info For SM
Forward Short Msg
Paging (516)
RRC Con Request (518)
RRC Con Setup (520)
RRC Con complete (522)
(service request (SMS only, KSI, MAC))
Initial UE Message (service request(SMS only,KSI,MAC), eNB UE S1AP id)) (524)
Service request (526)
DL Unit Data (SMS Msg) (528)
530
Initial UE Msg response (MME UE S1AP id) (530a)
Initial UE Msg response ack (530b)
532
Initial UE Msg response (service request accept, (MME UE S1AP id) (532a)
Initial UE Msg response ack (532c)
Downlink Transport (Service request accept) (532b)
Alternative-A
A. after receiving ACK in RLC layer about RRC Connection Complete message, activate NAS security (530c)
Alternative-B
B. after receiving service request accept from the MME, activate NAS security (532d)

FIG.5A

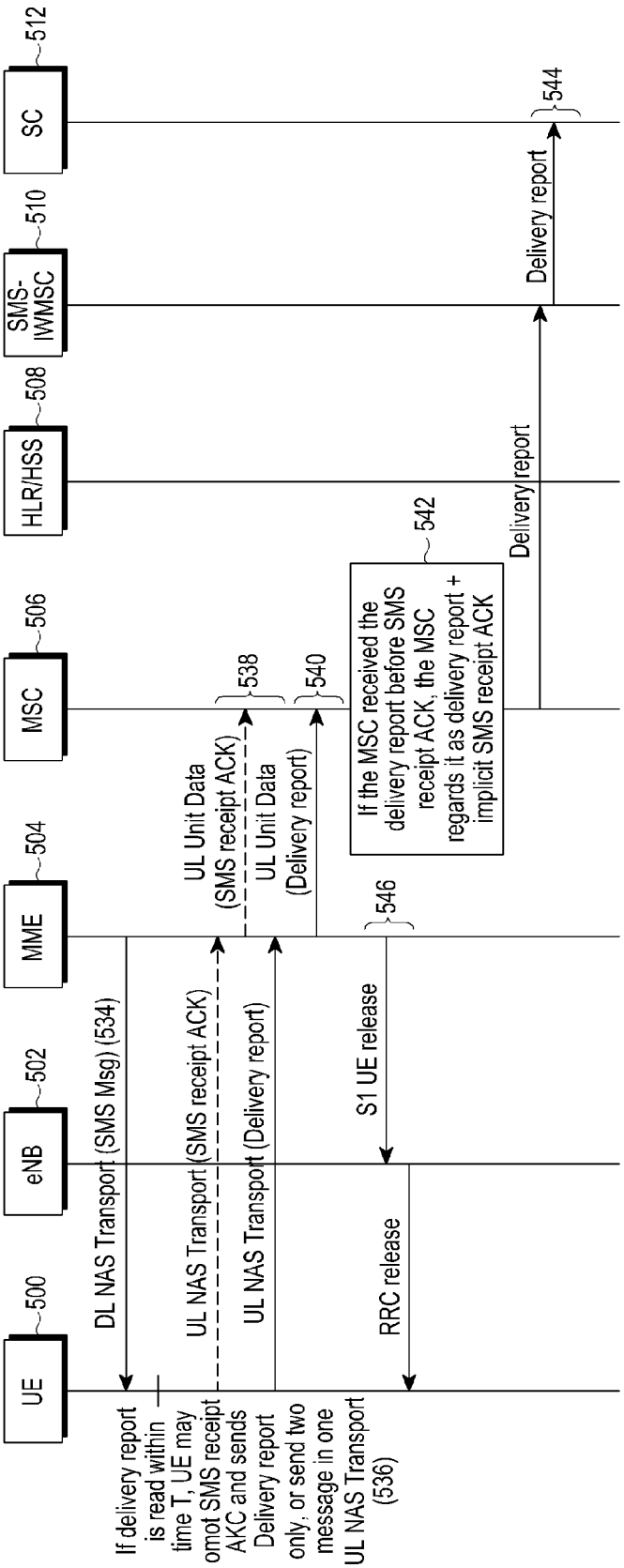

UE
500
eNB
502
MME
504
MSC
506
HLR/HSS
508
SMS-IWMSC
510
SC
512
DL NAS Transport (SMS Msg) (534)
UL NAS Transport (SMS receipt ACK)
UL NAS Transport (Delivery report)
S1 UE release
RRC release
UL Unit Data (SMS receipt ACK)
538
UL Unit Data (Delivery report)
540
546
If the MSC received the delivery report before SMS receipt ACK, the MSC regards it as delivery report + implicit SMS receipt ACK
542
Delivery report
Delivery report
544
If delivery report is read within time T, UE may omot SMS receipt AKC and sends Delivery report only, or send two message in one UL NAS Transport (536)

FIG.5B

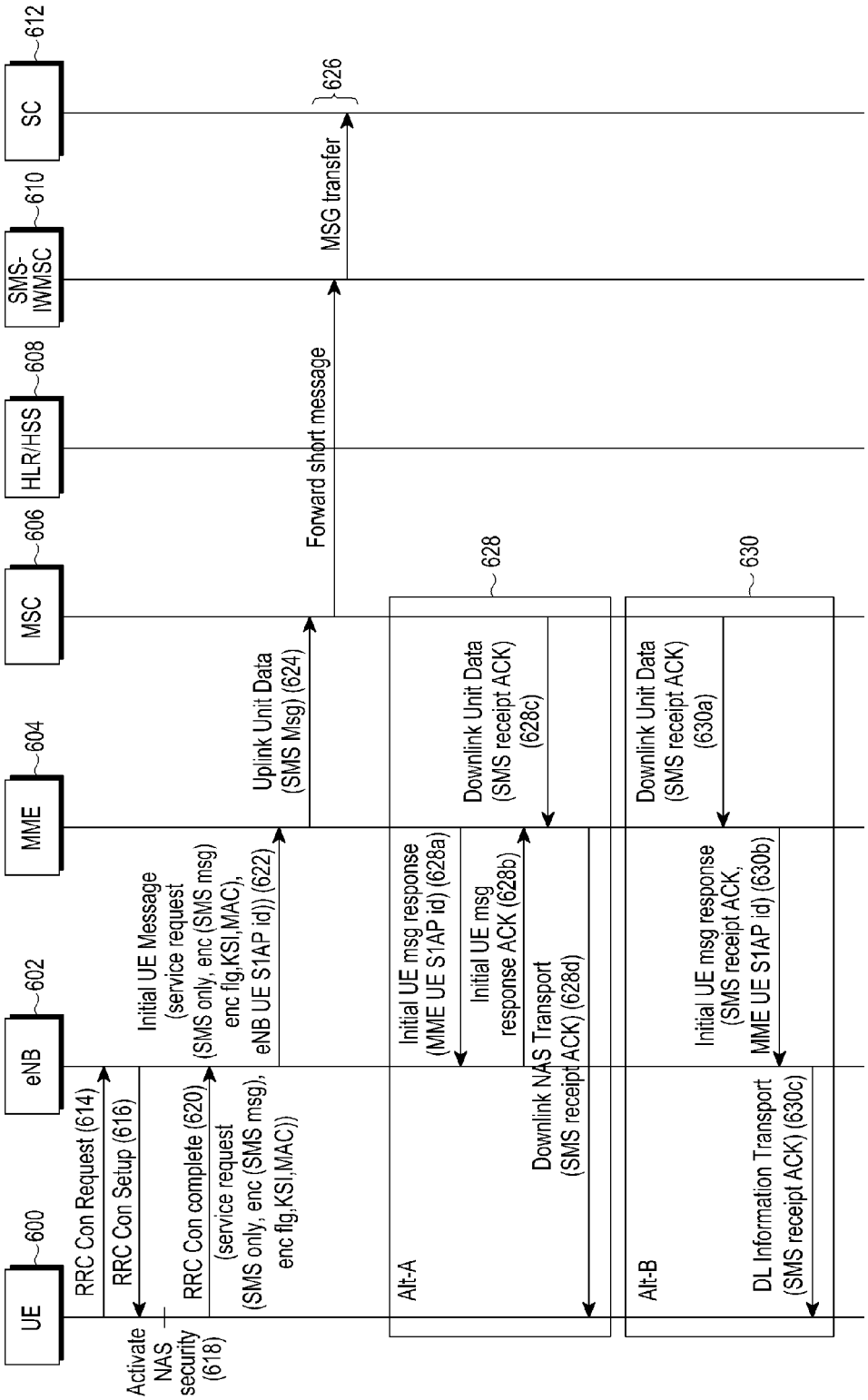

UE
600
eNB
602
MME
604
MSC
606
HLR/HSS
608
SMS-IWMSC
610
SC
612
626
RRC Con Request (614)
RRC Con Setup (616)
RRC Con complete (620)
(service request (SMS only, enc (SMS msg), enc flg,KSI,MAC))
Activate NAS security (618)
Initial UE Message (service request (SMS only, enc (SMS msg) enc flg,KSI,MAC), eNB UE S1AP id)) (622)
Uplink Unit Data (SMS Msg) (624)
Forward short message
MSG transfer
628
Initial UE msg response (MME UE S1AP id) (628a)
Initial UE msg response ACK (628b)
Downlink Unit Data (SMS receipt ACK) (628c)
Downlink NAS Transport (SMS receipt ACK) (628d)
Alt-A
630
Initial UE msg response (SMS receipt ACK, MME UE S1AP id) (630b)
Downlink Unit Data (SMS receipt ACK) (630a)
DL Information Transport (SMS receipt ACK) (630c)
Alt-B

FIG.6A

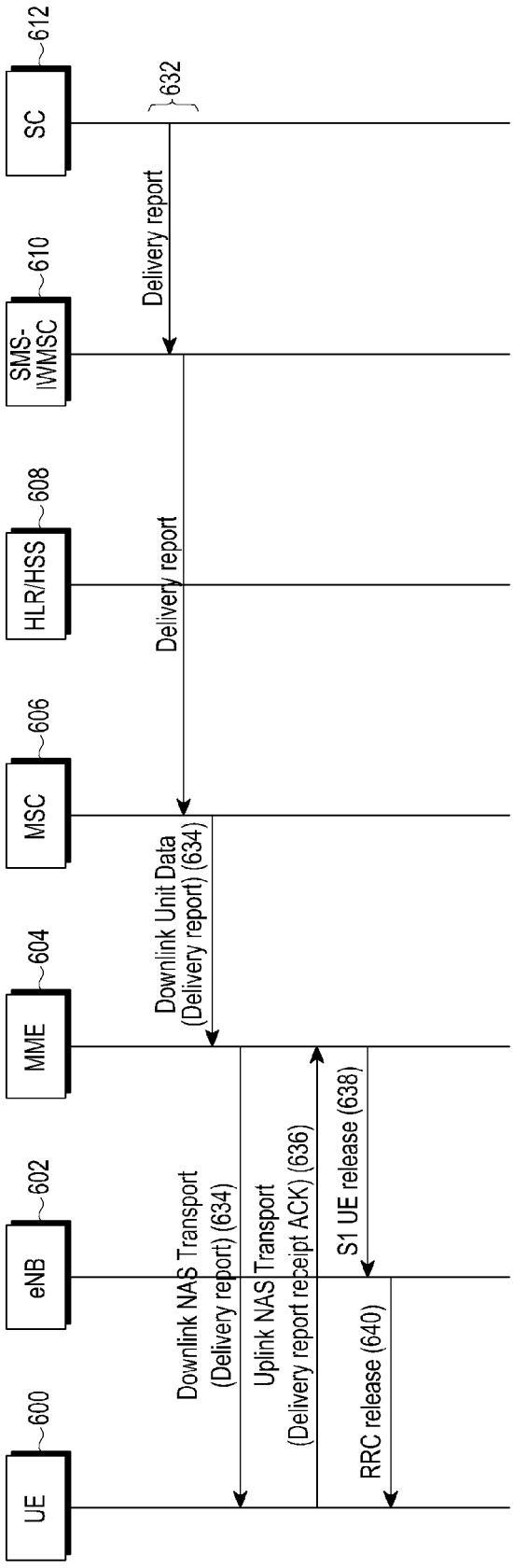

612
SC
632
Delivery report
610
SMS-IWMSC
608
HLR/HSS
Delivery report
606
MSC
Downlink Unit Data (Delivery report) (634)
604
MME
602
eNB
Downlink NAS Transport (Delivery report) (634)
Uplink NAS Transport (Delivery report receipt ACK) (636)
S1 UE release (638)
600
UE
RRC release (640)

FIG.6B

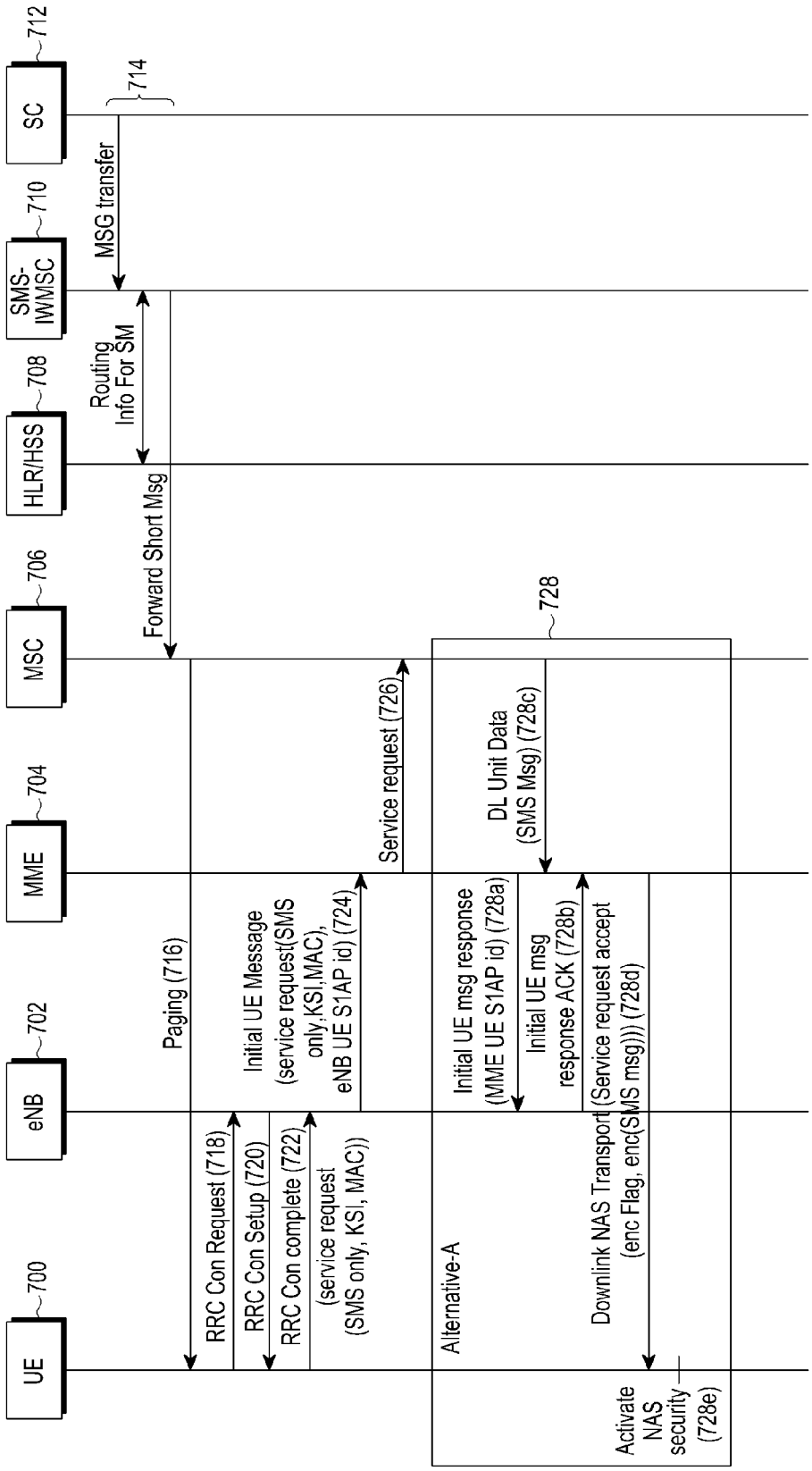

UE
700
eNB
702
MME
704
MSC
706
HLR/HSS
708
SMS-IWMSC
710
SC
712
714
MSG transfer
Routing Info For SM
Forward Short Msg
Paging (716)
RRC Con Request (718)
RRC Con Setup (720)
RRC Con complete (722)
(service request (SMS only, KSI, MAC))
Initial UE Message (service request(SMS only,KSI,MAC), eNB UE S1AP id) (724)
Service request (726)
728
Alternative-A
Initial UE msg response (MME UE S1AP id) (728a)
Initial UE msg response ACK (728b)
DL Unit Data (SMS Msg) (728c)
Downlink NAS Transport (Service request accept (enc Flag, enc(SMS msg))) (728d)
Activate NAS security (728e)

FIG. 7A

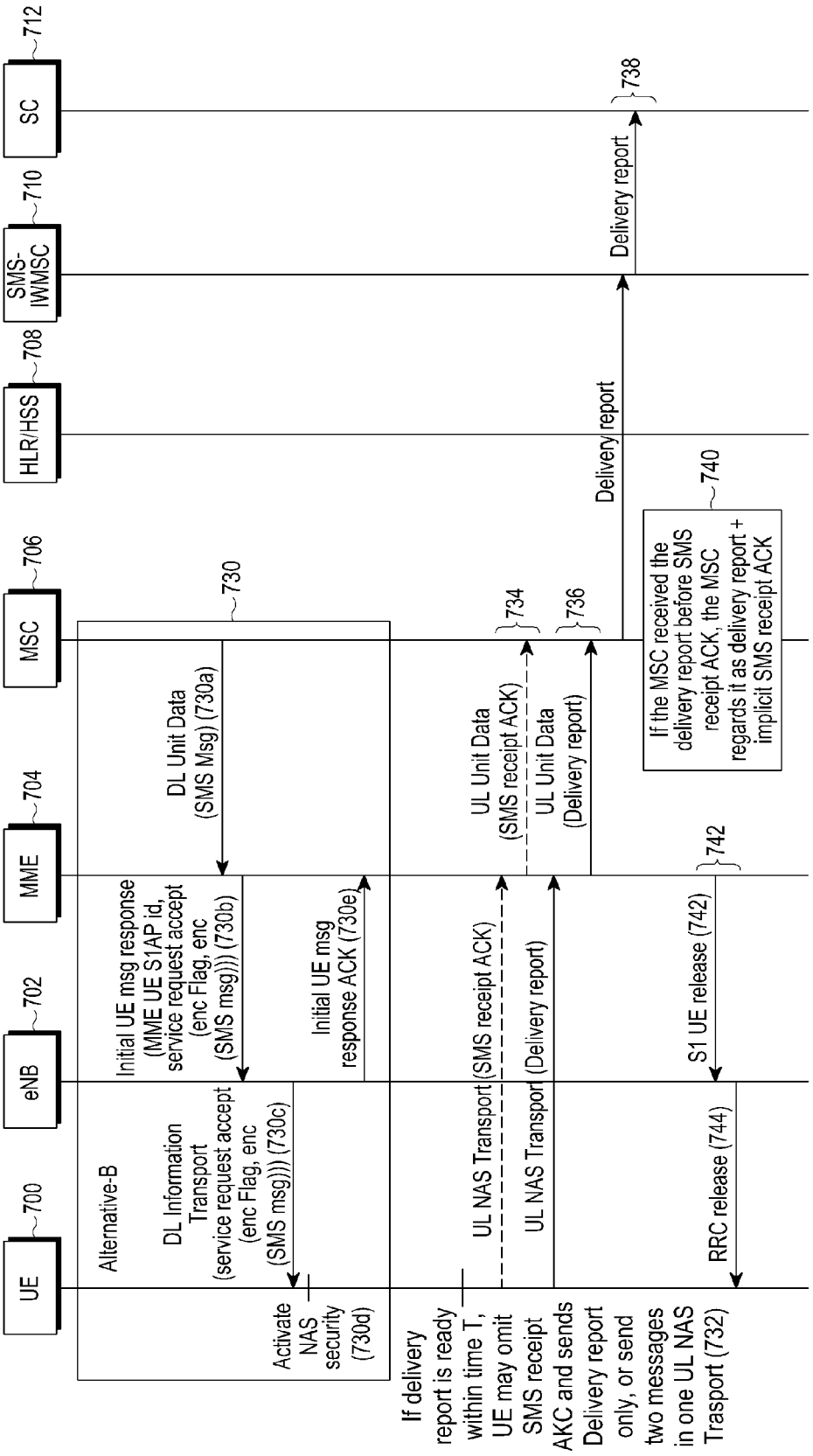

UE
700
eNB
702
MME
704
MSC
706
HLR/HSS
708
SMS-IWMSC
710
SC
712
Alternative-B
DL Information Transport (service request accept (enc Flag, enc (SMS msg))) (730c)
Activate NAS security (730d)
Initial UE msg response (MME UE S1AP id, service request accept (enc Flag, enc (SMS msg))) (730b)
Initial UE msg response ACK (730e)
DL Unit Data (SMS Msg) (730a)
730
UL NAS Transport (SMS receipt ACK)
UL Unit Data (SMS receipt ACK)
734
UL NAS Transport (Delivery report)
UL Unit Data (Delivery report)
736
Delivery report
738
If the MSC received the delivery report before SMS receipt ACK, the MSC regards it as delivery report + implicit SMS receipt ACK
740
S1 UE release (742)
742
RRC release (744)
If delivery report is ready within time T, UE may omit SMS receipt AKC and sends Delivery report only, or send two messages in one UL NAS Trasport (732)

FIG. 7B

METHOD AND SYSTEM FOR DELIVERING SMS (SHORT MESSAGE SERVICE) MESSAGES IN A MOBILE COMMUNICATION SYSTEM

PRIORITY

This application is a National Phase Entry of PCT International Application No. PCT/KR2011/003244, which was filed on Apr. 29, 2011, and claims priority to Korean Patent Application Nos. 10-2010-0041602, filed in Korea Patent Office on May 3, 2010, the contents are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a method and system for delivering Short Message Service (SMS) messages in a mobile communication system.

2. Description of the Related Art

Generally, SMS, a value-added service in mobile communication systems, refers to a service of sending short texts to the other party. At present, mobile communication systems such as Long Term Evolution (LTE) use a Circuit Switched Fall Back (CSFB) function that uses the Mobile Switching Center (MSC) existing in the legacy network. In terms of the delivery overhead, quite a lot of control messages are required to support a User Equipment (UE) in an idle state in sending one SMS message which is limited to 160 characters.

SUMMARY OF THE INVENTION

The present invention provides a method and system for efficiently providing an SMS service in an LTE system.

The present invention provides a method and system for reducing a load during an SMS service in an LTE system.

In accordance with one aspect of an embodiment of the present invention, there is provided a method for delivering a Short Message Service (SMS) message in a mobile communication system, the method including sending, by an SMS originating User Equipment (UE), to an evolved Node-B (eNB) a service request message for requesting SMS sending in a process of setting up RRC connection using a Radio Resource Control (RRC) connection complete message; sending, by the eNB, the received service request message to a Mobile Management Entity (MME) using an initial UE message; sending, by the MME, an 'initial context setup for signaling' message that does not include information about data bearers, to the eNB in response to the initial UE message; upon receiving the initial context setup message, setting up, by the eNB, Access Stratum (AS) security with the SMS originating UE; if AS security is set up, performing, by the SMS originating UE, Non Access Stratum (NAS) security with the MME; and upon completion of the NAS security process with the MME, transmitting, by the SMS originating UE, the SMS message to the MME using an uplink NAS transport message.

In accordance with another aspect of an embodiment of the present invention, there is provided a method for delivering a Short Message Service (SMS) message in a mobile communication system, the method including sending, by an SMS originating User Equipment (UE), to an evolved Node-B (eNB) a service request message for requesting SMS sending in a process of setting up RRC connection using a Radio Resource Control (RRC) connection complete message; sending, by the eNB, the received service request message to a Mobile Management Entity (MME) using an initial UE message; sending, by the MME, an initial UE message response message comprising information for Non Access Stratum (NAS) security setup to the eNB in response to the initial UE message; sending, by the eNB, an accept message with respect to the service request message to the SMS originating UE through downlink transmission; and upon receiving the accept message, sending, by the SMS originating UE, an SMS message to the MME using an uplink NAS transport message.

In accordance with further another aspect of an embodiment of the present invention, there is provided a method for delivering a Short Message Service (SMS) message in a mobile communication system, the method including activating, by an SMS originating User Equipment (UE), Non Access Stratum (NAS) security after receiving a Radio Resource Control (RRC) connection setup message from an evolved Node-B (eNB) in a process of setting up an RRC connection with the eNB; after the NAS security is activated, sending a service request message comprising an SMS message encrypted using an encryption key in security context of the activated NAS security and an indicator indicating SMS sending-only to the eNB using an RRC connection complete message; upon receiving the service request message, sending, by the eNB, an initial UE message comprising the service request message and a temporary identifier (eNB UE S1AP id) which the eNB allocates to identify the SMS originating UE to a Mobile Management Entity (MME); if the service request message is valid, decrypting, by the MME, an SMS message included in the service request message using the encryption key; and sending, by the MME, the decrypted SMS message to an SMS terminating UE via a Mobile Switching Center (MSC).

In accordance with still another aspect of an embodiment of the present invention, there is provided a system for delivering a Short Message Service (SMS) message in a mobile communication system, the system including an SMS originating User Equipment (UE) for sending a service request message for requesting SMS sending in a process of setting up RRC connection using a Radio Resource Control (RRC) connection complete message; an evolved Node-B (eNB) for sending the service request message included in the RRC message using an initial UE message, if receiving the RRC connection complete message when setting up the RRC connection with the SMS originating UE; and a Mobile Management Entity (MME) for sending an 'initial context setup for signaling' message which does not comprise information about data bearers to the eNB, if receiving the initial UE message from the eNB, in which the eNB, if receiving the initial context setup message, sets up Access Stratum (AS) security with the SMS originating UE, and if the AS security is set up, the SMS originating UE performs Non Access Stratum (NAS) security with the MME, and upon completion of the NAS security process with the MME, the SMS originating UE sends an SMS message to the MME using an uplink NAS transport message.

In accordance with yet another aspect of an embodiment of the present invention, there is provided a system for delivering a Short Message Service (SMS) message in a mobile communication system, the system including an SMS originating User Equipment (UE) for sending a service request message for requesting SMS sending in a process of setting up RRC connection using a Radio Resource Control (RRC) connection complete message; an evolved Node-B (eNB) for sending in response to the initial UE message, using an initial UE message, the service request message received when setting up the RRC connection with the SMS originating UE;

and a Mobile Management Entity (MME) for sending an initial UE message response message comprising information for setting up Non Access Stratum (NAS) security to the eNB in response to the initial UE message, if receiving the initial UE message from the eNB, in which the eNB sends an accept message with respect to the service request message to the SMS originating UE through downlink transmission, and the SMS originating UE having received the accept message sends an SMS message to the MME using an uplink NAS transport message.

According to the present invention, loads of a UE and an eNB, for SMS delivery, may be reduced in the evolved mobile communication systems.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an end-to-end signal flow diagram of sending an SMS message from an idle UE A to an idle UE B in an LTE system to which the present invention is applied;

FIG. **2** is a signal flow diagram of processing a Message Origination (MO) call during SMS sending according to a first embodiment of the present invention;

FIG. **3** is a signal flow diagram of processing a Message Termination (MT) call for SMS reception according to the first embodiment of the present invention;

FIG. **4** is a signal flow diagram of processing an MO call during SMS sending according to a second embodiment of the present invention;

FIG. **5** is a signal flow diagram of processing an MT call for SMS reception according to the second embodiment of the present invention;

FIG. **6** is a signal flow diagram of processing an MO call during SMS sending according to a third embodiment of the present invention; and

FIG. **7** is a signal flow diagram of processing an MT call for SMS reception according to the third embodiment of the present invention.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

Preferred embodiments of the present invention will be described in detail below with reference to the accompanying drawings. The same reference numerals are used throughout the drawings to refer to the same or like elements of embodiments of the present invention.

In the following description, specific details such as detailed configuration and components are merely provided to assist the overall understanding of exemplary embodiments of the present invention. Therefore, it should be apparent to those skilled in the art that various changes and modifications of the embodiments described herein can be made without departing from the scope and spirit of the invention. In addition, descriptions of well-known functions and constructions are omitted for clarity and conciseness.

In an LTE system to which the present invention is applied, in order to determine the amount of actual overload for SMS provision in terms of the entire system, an end-to-end signal flow diagram of sending one SMS message from a UE A in an idle state to a UE B in an idle state may be analyzed as shown in FIG. **1**.

FIG. **1** is an end-to-end signal flow diagram of sending an SMS message from an idle UE A **100** to an idle UE B **122** in an LTE system to which the present invention is applied. For convenience' sake, FIG. **1** is divided into FIG. **1**A and FIG. **1**B.

In step **124**, the UE A **100** in an idle state sends a Radio Resource Control (RRC) setup request message for making an RRC connection to an evolved Node-B (eNB) **102**, to send an SMS message.

Upon receiving the RRC setup request message from the UE A **100** in step **124**, the eNB **102** allocates a signal radio bearer and sends an RRC setup message including the allocation information to the UE A **100**, in step **126**.

Upon receiving the RRC setup message in step **126**, the UE A **100** sends a service request message for a connection with a Mobile Management Entity (MME) **104** to the eNB **102** using an RRC setup complete message in order to send an SMS message, in step **128**.

Upon receiving the RRC setup complete message in step **128**, the eNB **102** sends a service (SVC) request message that the UE A **100** sends to the MME **104**, using an initial UE message, in step **130**. The eNB **102** allocates eNB S1AP id, which is a temporary id for identifying a message from the UE A **100**, and then includes the temporary id in the initial UE message.

Upon receiving the initial UE message including the service request message from the UE A **100** in step **130**, the MME **104** activates a security context between the UE A **100** and the MME **104**, which it created according to an authentication procedure that it performed before the UE A **100** was in an idle state, and generates an Access Stratum (AS) security key used between the UE A **100** and the eNB **102**, based on a Non Access Stratum (NAS) security key in this context, in step **132**. The MME **104** activates a non-GBR bearer that the UE A **100** was using before it transitions to an idle state. In step **132**, the MME **104** includes the generated AS security key, information about non-GBR bearers to be activated, and MME S1 AP id, which is a temporary id allocated by the MME **104**, in an initial context setup message that the MME **104** sends to the eNB **102**, and sends the initial context setup message to the eNB **102**.

Upon receiving the initial context setup message in step **132**, the eNB **102** sends an AS security command message to the UE A **100** based on the AS security key included in the received message, in step **134**. In step **136**, the eNB **102** receives a response thereto and activates AS security. In step **138**, the eNB **102** activates radio bearers by performing RRC reconfiguration on the bearers to be activated.

If activation of radio bearers is successful, the UE A **100** activates NAS layer security in step **150**, interpreting it as an implicit signal implying that the MME **104** has accepted the service request from the UE A **100** (AS layer security is activated in step **136**).

If activation of radio bearers is successful, the eNB **102** notifies it to the MME **104** using an initial context setup response message in step **140**.

In step **142**, the UE A **100** sends an SMS message using the activated NAS key. (a NAS message is sent in an AS layer using a UL NAS transport, and is sent even in S1AP between the eNB **102** and the MME **104** using the UL NAS transport).

Upon receiving the SMS message from the UE A **100** in step **142**, the MME **104** sends it to an MSC/Visitor Location Register (VLR) **106** in step **144**.

In step **148**, the MSC/VLR **106** sends ACK indicating its reception of the SMS message to the UE A **100** to prevent the UE A **100** from retransmitting the SMS message. In step **146**, the MSC/VLR **106** forwards the SMS message to an SMS-Interworking MSC (IWMSC) **108** to send the SMS message to an SMS recipient (UE B **122**).

In step **152**, the SMS-IWMSC **108** sends the SMS message to an SMS Center (SC) **110**.

In step **154**, the SC **110** sends the received SMS message to a SMS-Gateway Mobile Switching Center (GMSC) **112**.

In step **156**, the SMS-GMSC **112** finds out routing information for an SMS receiving side (UE B **122**), i.e., information about an MSC that can send an SMS message to the receiving side, via a Home Location Register/Home Subscribe Server (HLR/HSS) **114**.

In step **158**, the SMS-GMSC **112** forwards the SMS message to a receiving side-related MSC **116**. In step **160**, if the UE B **122**, or an SMS receiving (or terminating) UE, is in an idle state, the MSC **116** sends a paging to the UE B **122** via an MME **118** and an eNB **120**, in order to switch the UE B **122** to an active state.

Upon receiving the paging in step **160**, the UE B **122** establishes an RRC connection with the eNB **120** and sends a service request message for responding to the paging to the eNB **120** in step **162**, in order to respond to the paging.

In step **164**, the eNB **120** sends a service (SVC) request message from the UE B **122** to the MME **118** using an initial UE message.

After receiving the service request message, the MME **118** sends the service request message to the MSC **116** to the MSC **116** in step **166** in order to receive from the MSC **116** the SMS message to be delivered to the UE B **122**. Upon receiving the service request message from the MME **118**, the MSC **116** sends the SMS message to the MME **118** through downlink unit data in step **168**.

In step **170**, the MME **118** sends an initial UE context setup request message to the eNB **120** in order to perform AS security and non-GBR bearer activation for the UE B **122** that sent the service request message in step **162**. Upon receiving the initial UE context setup request message in step **170**, the eNB **120** activates AS security by sending and receiving security mode command/complete messages, and activates non-GEBR bearers using an RRC reconfiguration/complete message, in step **172**.

If activation of radio bearers is successful, the UE B **122** activates NAS layer security, interpreting it as an implicit signal implying that the MME **118** has accepted the service request message from the UE B **122** (AS layer security is activated in step **172**). In step **174**, if activation of radio bearers is successful, the eNB **120** notifies it to the MME **118** using an initial context setup response message. In step **176**, the MME **118** encrypts the SMS message received from the MSC **116** using the activated NAS security, attaches MAC for integrity check thereto, and then delivers the resulting SMS message to the UE B **122** using a NAS message.

Upon receiving the SMS message in step **176**, the UE B **122** sends ACK indicating its reception of the SMS message to the MSC **116** via the MME **118** in step **177** in order to prevent the MSC **116** from retransmitting the SMS message.

After receiving the SMS message, the UE B **122** sends a delivery report message, which it sends to the SC **110**, to the MSC **116** via the MME **118** in steps **178** and **180**. In step **182**, the MSC **116** sends ACK indicating its reception of the delivery report message to the UE B **122** via the MME **118**.

The delivery report message, sent by the UE B **122** or a SMS receiving UE, is sent by the MSC **116** to the SC **110** via the SMS-GMSC **112** in step **184**.

In step **186**, the SC **110** sends the received delivery report message to the UE A **100**, which is a UE that has sent the SMS message, via the SMS-IWMSC **108**, the MSC/VLR **106**, and the MME **104**.

Upon receiving the delivery report message in step **186**, the UE A **100** or an SMS sending (or originating) terminal sends ACK, which is a response to the delivery report message, to the MSC/VLR **106** in step **188**.

In the above-described process of FIG. **1**, in which Message Origination (MO) and delivery report for SMS sending are processed, an SMS message is received once at the SC **110** that relays SMS messages, an SMS message is sent once by the SC **110**, a report on SMS delivery is received once at the SC **110**, and a report on SMS delivery is sent once by the SC **110**, so the SC **110** receives a total of two messages and sends a total of two messages. The MSCs **106** and **116** receive a total of three messages and send a total of three messages. However, the SMS sending/receiving terminals **100** and **122**, and the eNBs **102** and **120** each send a total of six messages and receive a total of six messages, and the MME **118** sends a total of four messages and receives a total of four messages. The number of messages sent and received by/at each UE and each network entity is listed in Table 1 below, showing that when SMS messages are sent and received using the CSFB function, most of the load is concentrated on the UEs, the eNBs and the MMEs.

TABLE 1

	UE	eNB	MME	MSC	SC
MSG Tx	6	9	5	3	2
MSG Rx	5	9	6	3	2

The present invention provides the following embodiments for reducing the loads of UEs and eNBs during SMS delivery in a mobile communication system such as LTE, to which the present invention is applied, like Table 1.

First Embodiment

A first embodiment of the present invention corresponds to a method in which if a UE **200** sends only SMS messages, no data bearer is set up between the UE **200** and an eNB **202**.

FIG. **2** is a signal flow diagram of processing a Message Origination (MO) call during SMS sending according to a first embodiment of the present invention. Although FIG. **2**A and FIG. **2**B form one drawing, they are separated for convenience' sake.

In step **214**, a UE **200** or an SMS originating UE sends an RRC connection request message to an eNB **202** to request an RRC connection. In step **216**, the eNB **202** sends an RRC connection setup message to the UE **200** in response to the RRC connection request message received in step **214**.

In step **218**, the UE **200** sends an RRC connection complete message. During the sending, the UE **200** includes a service request message in the RRC connection complete message. The service request message includes an indicator 'SMS only' indicating SMS sending-only, a Key Set Indicator (KSI), and MAC. The KSI is information indicating a set of an encryption/decryption key allocated through recent authentication, an encryption/decryption key used for integrity assurance/check, and an integrity assurance/check key, and the MAC is a sort of hash value calculated using an Integrity Key (IK). The KSI and the MAC are terms generally used in the technical field of the present invention, and thus will not described in detail. This service request message is sent to an MME **204** via the eNB **202** using an initial UE message in step **220**.

In step **220**, the eNB **202** allocates an eNB UE S1AP id, which is a temporary id of a UE and is to be used in an SLAP connection (a temporary id the eNB **202** allocates to identify the UE A **200**), and includes it as a parameter of the initial UE message. Upon receiving the initial UE message in step **220**,

the MME **204** sends an 'initial context setup for signaling' message to the eNB **202**, for a UE for SMS exchange, in step **222**.

Since no data bearer will be set up between the UE **200** and the eNB **202** in the first embodiment of the present invention, the 'initial context setup for signaling' message to be sent in the initial context setup for signaling, to be performed in step **222** does not include information about data bearers, and the MME **204** sends MME UE S1AP id that the MME **204** allocates as a temporary id of a UE in an S1AP connection (a temporary id the MME **204** temporarily allocates to identify the UE **200**) and a Key of eNB (KeNB) necessary for the eNB **202** to set up AS security, using a parameter.

Upon receiving the 'initial context setup for signaling' message that the MME **204** sent in step **222**, the eNB **202** sets up only AS security and sets up no radio bearer corresponding to the data bearer. In step **224**, the eNB **202** sends an AS security command (SEC MOD CMD) message to the UE **200**.

If AS security is successfully set up, the UE **200** having received the AS security mode command in step **224** activates NAS security in step **226**, considering that the MME **204** has accepted the service request (SMS only, etc.) of step **218** from the UE **200**. In step **228**, the UE **200** sends a security mode (SEC MOD) complete message to the eNB **202** in response to step **224**. The AS security refers to security between the eNB **202** and the UE **200**, and the NAS security refers to security between the UE **200** and the MME **204**.

After activating AS security, the eNB **202** transmits the results to the MME **204** using an 'initial context setup complete for signaling' message in step **230**.

In step **232**, the UE **200** sends an SMS message to the MME **204** using an uplink NAS transport message. In step **234**, the MME **204** sends the SMS message to an MSC **206** using uplink unit data. Steps **232** and **234** in FIG. **2** correspond to steps **142** and **144** in FIG. **1**.

Upon receiving the SMS message from the MME **204** in step **234**, the MSC **206** forwards the received SMS message to an SC **212** via an SMS-IWMSC **210** in step **236**. In step **238**, the MSC **206** transmits an SMS receipt ACK message informing the UE **200** of the normal reception of the SMS message to the MME **204** through downlink unit data. In step **240**, the MME **204** sends the SMS receipt ACK to the UE **200** using a downlink NAS transport message. Steps **238** and **240** correspond to details of step **148** in FIG. **1**.

In step **242**, the SC **212** sends a delivery report message to the MSC **206** via the SMS-IWMSC **210**.

Upon receiving the downlink NAS transport message in step **240**, the UE **200** sends an ACK message for indicating its reception of the delivery report message, to the MME **204** using an uplink NAS transport message in step **248**. Step **248** corresponds to step **188** in FIG. **1**. Through steps **250** and **252**, the connection between the MME **204**, the eNB **202** and the UE **200** is released.

A process of processing a Message Termination (MT) call for SMS reception according to the first embodiment of the present invention will be described below with reference to FIG. **3**. FIG. **3** is a signal flow diagram of processing a Message Termination (MT) call for SMS reception according to the first embodiment of the present invention. FIGS. **3**A and **3**B form one drawing, but they are separated for convenience' sake.

In step **314**, an SC **312** forwards an SMS message received from an SMS originating UE to an MSC **306** via an SMS-IWMSC **310** and an HLR/HSS **308**. In step **316**, the MSC **306** sends a paging message to a UE **300** that is to receive the SMS message.

Upon receiving the paging message, the UE **300** sends an RRC connection request message to an eNB **302** in step **318**. In response thereto, the eNB **302** sends an RRC connection setup message to the UE **300** in step **320**.

Upon receiving the RRC connection setup message, the UE **300** sends an RRC connection complete message to the eNB **302** in step **322**. The RRC connection complete message includes a service request message. The service request message includes an indicator 'SMS only information' indicating that the service request message is only for SMS sending, KSI, and MAC. Upon receiving the service request message, the eNB **302** sends the service request message to an MME **304** using an initial UE message in step **324**. In step **324**, the eNB **302** allocates an S1AP eNB UE id, which is a temporary id of a UE and is to be used in an S1AP connection, and sends it using a parameter of the initial UE message.

Upon receiving the initial UE message, the MME **304** sends an 'initial context setup for signaling' message to the eNB **302**, for a UE for SMS exchange, in step **326**. Since no data bearer will be set up between the UE **300** and the eNB **302** in the first embodiment, the 'initial context setup for signaling' message for signaling to be performed in step **326** does not include information about data bearers, and the service request message and an S1AP MME UE id that the MME **304** allocates as a temporary id of a UE in S1AP connection are sent using a parameter.

Upon receiving the 'initial context setup for signaling' message that the MME **304** sent in step **326**, the eNB **302** sets up only AS security and sets up no radio bearer corresponding to the data bearer. In step **328**, the eNB **302** sends an AS security command (SEC MOD CMD) message to the UE **300**. If AS security is successfully set up, the UE **300** having received the AS security command message activates NAS security in step **330**, considering that the MME **304** has accepted the service request (SMS only, etc.) for the UE **300**. In step **332**, the UE **300** sends a security mode (SEC MOD) complete message to the eNB **302** in response to step **328**.

After activating AS security, the eNB **302** having received the security mode complete message transmits the results to the MME **304** using an 'initial context setup for signaling complete' message in step **334**. In step **336**, the MME **304** sends a service request message to the MSC **306** in order to request sending of the SMS message that the MSC **306** received in step **314**.

Upon receiving the service request message from the MME **304** in step **336**, the MSC **306** forwards the SMS message to the UE **300** via the MME **304** in step **338**.

Upon receiving the SMS message in step **338**, the UE **300** may send only a delivery report message, omitting SMS receipt ACK message transmission in step **340**, if a delivery report transmission time for the received SMS message is less than a preset timer value T. In step **340**, the UE **300** may determine whether to send both an SMS receipt ACK message and a delivery report message using one UL NAS transport message.

In step **342**, the UE **300** sends an SMS receipt ACK message for indicating the normal reception of an SMS message. However, the UE **300** may omit step **342**, if it determines in step **340** to send a delivery report message within a preset timer value.

In step **344**, the UE **300** sends a delivery report to the MSC **306** via the MME **304**. The SMS receipt ACK message sent in step **342** may be sent together with a delivery report message using a UL NAS transport message that is sent in step **344**.

Upon receiving the delivery report message in step **344**, the MSC **306** sends the received delivery report message to the SC **312** in step **346**.

In step **348**, if the MSC **306** receives a delivery report message before receiving an SMS receipt ACK, it considers that the UE **300** has successfully received an SMS message.

In step **350**, the MSC **306** sends a delivery report receipt ACK message to the UE **300** via the MME **304**. In step **352**, the MME **304** and the eNB **302** release their connection with the UE **300**.

The process of processing an MT call for SMS reception in the first embodiment of the present invention is different the process of processing an MO call for SMS sending in that the paging reception triggers the service request for the UE **300**. In addition, the process of processing an MT call for SMS reception is different from the process of processing an MO call for SMS sending in FIG. **2** in that after receiving the SMS message, the UE **300** sends an ACK for SMS message receipt and a delivery report using one UL NAS transport message, or the UE **300** sends only the delivery report and upon receiving it, the MME **304** may determine that ACK for SMS message receipt is implicitly included.

According to the first embodiment of the present invention, messages sent and received by/at a UE and an eNB are reduced in number by 2 and 4 in total, respectively, as shown in Table 2, compared to Table 1.

TABLE 2

	UE	eNB	MME	MSC	SC
MSG Tx	5	8	4	3	2
MSG Rx	4	8	5	3	2

Second Embodiment

A second embodiment of the present invention corresponds to a method in which if a UE sends only SMS messages, no data bearers and no AS securities are set up.

The second embodiment of the present invention is characterized in that the AS securities as well as the data bearers are not set up. If a UE in an idle state intends to send one SMS message, the UE makes an RRC connection, sends one SMS message in a NAS message, and then, immediately releases the RRC connection, so additional RRC messages are not likely to occur. Since the SMS message is protected by NAS security by being sent in a NAS message, the need for AS security setup is low. Therefore, in the second embodiment of the present invention, data bearers are not set up and AS securities are not activated.

A signal flow diagram of processing an MO call during SMS sending according to a second embodiment of the present invention is as shown in FIG. **4**. FIG. **4**A and FIG. **4**B form one drawing, but they are separated for convenience' sake.

Steps **414** to **420** in FIG. **4** are the same as steps **214** to **220** in FIG. **2**, so description thereof will be omitted.

After receiving an initial UE message in step **420**, an MME **404** sends to an eNB **402** an initial UE message response that does not include a data bearer context and KeNB 'eNB key' for AS security setup and includes a service accept message for the service request message transmitted in step **418** and an MME UE S1AP id, in step **424**. In the second embodiment of the present invention, since data bearer and AS security are not setup, the MME **404** sends the initial UE message response, which does not include a KeNB unlike in the first embodiment of the present invention, to the eNB **402** in step **424**.

In step **426**, the eNB **402** sends Service request Accept, which is Accept for a service request message that a UE **400** sent, to the UE **400** using a downlink transport message.

In the second embodiment of the present invention, the UE **400** may activate NAS security in any one of steps **422** and **428**.

Step **422** represents a case in which the UE **400** performs NAS security activation after checking a response with respect to an RRC connection complete message including a service request message in an RLC layer which is a lower layer of RRC, and step **428** represents a case in which the UE **400** performs NAS security activation after receiving a Service request Accept message that the MME **404** explicitly sent in step **426**. In other words, in the second embodiment of the present invention, the UE **400** may perform NAS security activation in step **422** or step **428**.

In step **430**, the eNB **402** sends an initial UE message response ACK to the MME **404**. Steps **432** to **452** are the same as steps **232** to **252**, so detailed description thereof will be omitted.

In other words, the process of processing an MO call for SMS sending according to the second embodiment of the present invention is different from the process of processing an MO call for SMS sending according to the first embodiment of the present invention, in the process in which as shown in FIG. **4**, after receiving an initial UE message in step **420**, the MME **404** sends to the eNB **402** an initial UE message response that does not include a data bearer context and KeNB for AS security setup, in step **424**; in the process in which upon receiving the response, the eNB **402** sends an initial UE message ACK message to the MME **404** in step **430**; in the process (step **422**) in which the UE **400** activates NAS security after checking the success in sending of an RRC connection complete message in RLC which is a lower layer of RRC that sends a service request; or in the process (step **428**) in which the UE **400** activates NAS security after receiving the response message with respect to the service request that the MME **404** explicitly sent.

A process of processing an MT call for SMS reception according to the second embodiment of the present invention will be described below with reference to FIG. **5**. FIG. **5**A and FIG. **5**B form one drawing, but they are separated for convenience' sake.

Steps **514** to **524** in FIG. **5** are the same as steps **314** to **324** in FIG. **3**, so detailed description thereof will be omitted.

In step **526**, an MME **504** sends a service request message to an MSC **506**. In step **528**, the MSC **506** sends an SMS message received in step **514** to the MME **504** using DL unit data.

In the second embodiment of the present invention, a UE **500** selectively performs step **530** or step **532** depending on the time that NAS security activation is performed. Step **530** shows a case (step **530***c*) in which NAS security activation for the UE **500** is performed after the UE **500** receives an ACK message from an RLC layer, for the RRC connection complete message, and step **532** shows a case (step **532***d*) in which NAS security activation for the UE **500** is performed after the UE **500** receives a service request accept message from the MME **504**.

The procedure performed in step **530** will be described in detail. In step **530***a*, the MME **504** sends an initial UE message response message to an eNB **502**, and in response thereto, the eNB **502** sends an initial UE message response ACK message to the MME **504** in step **530***b*. In step **530***c*, the UE **500** performs NAS security activation.

The procedure performed in step **532** will be described in detail. In step **532***a*, the MME **504** sends an initial UE mes-

sage response message to the eNB **502**. In step **532***b*, the eNB **502** sends a downlink transport message including a service request accept message, to the UE **500**. In step **532***c*, the eNB **502** sends an initial UE message response ACK message to the MME **504** in response to step **532***a*. In step **532***d*, the UE **500** performs NAS security activation.

In step **534**, the MME **504** forwards the SMS message received in step **528** to the UE **500** using a DL NAS transport message, and the UE **500** performs step **536**. Step **536** is the same as step **340** in FIG. **3**, step **538** is the same as step **342** in FIG. **3**, and step **540** is the same as step **344** in FIG. **3**, so detailed description thereof will be omitted.

In addition, steps **542**, **544** and **546** in FIG. **5** are the same as steps **348**, **346** and **352** in FIG. **3**, respectively, so detailed description thereof will be omitted.

As described above, like the process of processing an MO call for SMS sending according to the second embodiment, the process of processing an MT call for SMS sending according to the second embodiment of the present invention is characterized in that the eNB **502** and the MME **504** exchange an initial UE message response message that does not include a data bearer context and KeNB for AS security setup, and an initial UE message ACK message, and NAS security activation for the UE **500** may be performed in any one of steps **530***c* and **532***b*. According to the second embodiment of the present invention, the messages sent and received by/at a UE and an eNB are reduced in number by 3 and 6 in total, respectively, as shown in Table 3, compared to Table 1.

TABLE 3

	UE	eNB	MME	MSC	SC
MSG Tx	4	8 (7*)	4	3	2
MSG Rx	4 (3*)	7	5	3	2

In Table 3, (number*) represents a case where service accept is not used and NAS security is activated by ACK from RLC.

Third Embodiment

A third embodiment of the present invention corresponds to a method in which if a UE sends only SMS messages, NAS security is activated before sending of a service request message and an SMS message is sent in a service request message.

In the third embodiment of the present invention, a radio bearer for signaling is allocated when an eNB **602** sends an RRC connection setup message after a UE **600** sends an RRC connection request message to the eNB **602**. Thus, thereafter, a NAS message may be send using the allocated radio bearer. In other words, the service request message is sent on a dedicated radio bearer allocated to a UE, so that unlike when a common signaling channel is shared, an SMS message, for which the limit in message size is a maximum of 160 bytes, may be included in the service request message. Therefore, the third embodiment of the present invention provides a method of sending an SMS message in a service request message and a service request accept message as in FIGS. **6** and **7**.

A process of processing an MO call during SMS sending according to a third embodiment of the present invention will be described below with reference to FIG. **6**. FIGS. **6**A and **6**B form one drawing, but they are separated for convenience' sake.

Steps **614** and **616** are the same as steps **214** and **216** in FIG. **2**, respectively, so detailed description thereof will be omitted. After receiving an RRC connection setup message from the eNB **602** in step **616**, the UE **600** activates NAS security before sending a service request message, in step **616**. In step **620**, the UE **600** encrypts the SMS message using a security key, which is an encryption key, in the activated security context, includes it in a service request message, and sends the service request message to the eNB **602** using an RRC connection complete message. The service request message may include an indicator 'SMS only' indicating that the service request message is only for SMS sending, KSI, MAC, the encrypted SMS message (enc(SMS msg)), and flag information indicating that the SMS message has been encrypted (enc fig). In step **620**, the UE **600** sends only a MAC for integrity check in the service request message without encrypting the service request message itself in the existing manner.

While only the SMS message has been encrypted and sent in step **620** of FIG. **6**A, according to another variation, the service request message including the SMS message as well as the SMS message are encrypted and then the MAC may be delivered to the MME **604** together with the encrypted service request message. In this case, the MME **604** performs verification with respect to the MAC and upon completion of verification with respect to the MAC, the encrypted service request message is decrypted using a previously stored security context to extract the SMS message included in the service request message and send the extracted SMS message to the MSC **606**.

Upon receiving the RRC connection complete message including the service request message in step **620**, the eNB **602** sends an initial UE message including the service request message and the eNB UE S1AP id to an MME **604** in step **622**. Upon receiving the initial UE message in step **622**, the MME **604** performs integrity check using a MAC code included in the service request message, and if its validity is identified, the MME **604** activates the security context. The MME **604** then decrypts the SMS message included in the service request message using the security key (encryption key) included in the security context, and then sends the decrypted SMS message to the MSC **606** in step **624**. Step **626** is the same as step **236** in FIG. **2**, so its detailed description will be omitted.

In the third embodiment of the present invention, for the process after the MME **604** sends an SMS message to an MSC **606**, two kinds of steps **628** and **630** are possible.

Step **628** "Alternative A" corresponds to a case where the MME **604** independently handles the SMS receipt ACK message and the initial UE message. In other words, the MME **604** sends an initial UE message response message to the eNB **602** in step **628***a* after receiving the initial UE message including a service request message in step **622**, and receives an initial UE message response ACK message from the eNB **602** in step **628***b*. The MME **604** sends an SMS receipt ACK message that the MSC **606** sent in step **628***c*, to the UE **600** in step **628***d*, after sending the SMS message included in the service request message to the MSC **606** in step **624**.

As such, in FIG. **6**, the initial UE message response and the SMS receipt response may be separately handled or they may be handled at the same time.

However, step **630** "Alternative B" corresponds to a case where the MME **604** handles the SMS receipt ACK message and the initial UE message together. In other words, after receiving the initial UE message including a service request message from the eNB **602** in step **622**, a procedure after sending the SMS message in the service request message to the MSC **606** in step **624** is different from step **628**. That is, upon receiving an SMS receipt ACK message from the MSC **606** in step **630***a*, the MME **604** sends the received SMS receipt ACK message to the eNB **602** along with an initial UE

message response message in step **630***b*. In step **630***c*, the eNB **602** sends the SMS receipt ACK message to the UE **600** using a DL information transport message.

Steps **632** to **640** are the same as steps **242** to **252** in FIG. **2**, so detailed description thereof will be omitted.

A process of processing an MT call for SMS reception according to the third embodiment of the present invention will be described with reference to FIG. **7**.

FIG. **7** is a signal flow diagram of processing an MT call for SMS reception according to the third embodiment of the present invention. FIGS. **7**A and **7**B form one drawing, but they are separated for convenience' sake.

Steps **714** to **726** are the same as steps **514** to **526** in FIG. **5**, so detailed description thereof will be omitted.

Any one of steps **728** and **730** may be performed depending on whether an MME **704** independently handles the initial UE message or handles it along with the SMS message in the process of processing an MT call for SMS reception in the third embodiment of the present invention.

The procedure performed in step **728** will be described in detail. In step **728***a*, the MME **704** sends a response to an initial UE message received in step **724**, to an eNB **702**. In step **728***b*, the eNB **702** sends to the MME **704** an ACK message indicating that it has received the initial UE message response message in step **728***a*.

In step **728***c*, an MSC **706** sends the SMS message it received in step **714**, to the MME **704**. In step **728***d*, the MME **704** sends, to a UE **700**, a service request accept message with an SMS message and a flag encFlag indicating the inclusion of an encrypted SMS message, using a downlink NAS transport message.

Upon receiving the downlink NAS transport message, the UE **700** checks the encFlag, and activates NAS security in step **728***e*. Thereafter, the UE **700** decrypts the encrypted SMS message that was sent together with the service request accept message using an encryption key in the activated NAS security context.

Next, the procedure performed in step **730** will be described in detail. In step **730***a*, the MSC **706** sends the SMS message received in step **714** to the MME **704**. In step **730***b*, the MME **704** sends to the eNB **702** a response to the initial UE message it received in step **724**. Upon receiving the initial UE message response in step **730***b*, the eNB **702** sends a service request accept message with an SMS message and a flag enc Flag indicating the inclusion of an encrypted SMS message, to the UE **700** using a downlink NAS transport message in step **730***c*.

On the other hand, as another variation of steps **730***b* and **730***c*, if the MME **704** encrypts an SMS message and a service request message including the SMS message instead of encrypting only the SMS message, and adds an MAC for transmission to the UE **700**, then the UE **700** having received the encrypted message first performs verification with respect to the MAC and, upon completion of verification with respect to the MAC, decrypts the service request message including the SMS message by using a previously stored security context and extracts the SMS message included in the service request message.

Upon receiving the downlink NAS transport message, the UE **700** checks the enc Flag and activates NAS security in step **730***d*. Thereafter, the UE **700** decrypts the encrypted SMS message that was sent together with the service request accept message, using an encryption key in the activated NAS security context. In step **730***e*, the eNB **702** sends to the MME **704** an ACK indicating that it has received the initial UE message response message in step **730***b*.

Steps **732** to **736** in FIG. **7** are the same as steps **536** to **540** in FIG. **5**, so detailed description thereof will be omitted. Further, steps **738**, **740** and **742** in FIG. **7** are the same as steps **544**, **542** and **546** in FIG. **5**, so detailed description thereof will be omitted.

Although it is assumed that NAS security is activated in any one of steps **728** and **730** in the process of processing an MT call for SMS reception according to the third embodiment of the present invention, NAS security may be activated in between steps **720** and **722** if the UE **700** may determine that it receives only the SMS service over Circuit Switched (CS) service, based on the paging message it received in step **716**.

The processing of an MT call according to the third embodiment of the present invention, like the processing of an MO call, sends the SMS message using initial UE message response message. Receiving a paging for SMS message reception, sending a service request message according thereto, and activating NAS security in the third embodiment of the present invention are the same as those in the second embodiment of the present invention.

However, the third embodiment is different from the second embodiment in that after sending an RRC connection complete message in step **722**, the UE **700** receives the service request accept message with an SMS message from the eNB **702** in step **728***d* or **730***c*, checks encFlag indicating the inclusion of the encrypted SMS message, activates NAS security in step **728***e* or **730***d*, and then decrypts the encrypted SMS message that was sent together with the service request accept message, using the encryption key in the activated NAS security context. Like the MO call processing, the MME **704** may handle the initial UE message together with the SMS message as in Alternative-A (step **728**), or may handle them independently as in Alternative-B (step **730**).

According to the third embodiment of the present invention, the messages sent and received by/at a UE and an eNB are reduced in number by 5 and 6, respectively, i.e., by 11 in total, as shown in Table 4 below, compared to Table 1.

TABLE 4

	UE	eNB	MME	MSC	SC
MSG Tx	3	6 (5*)	4	3	2
MSG Rx	3	6 (5*)	5	3	2

In table 4, (number*) represents the number of control messages in alternative-B.

The invention claimed is:

1. A method for delivering data in a mobile communication system, method comprising:

sending, by an originating User Equipment (UE), to an evolved Node-B (eNB) a service request message for requesting data sending in a process of setting up a Radio Resource Control (RRC) connection using a RRC connection complete message;

sending, by the eNB, the received service request message to a Mobile Management Entity (MME) using an initial UE message;

sending, by the MME, an initial context setup for signaling message that does not include information about data bearers, to the eNB in response to the initial UE message;

upon receiving the initial context setup for signaling message, setting up, by the eNB, Access Stratum (AS) security with the originating UE;

if the AS security is set up, performing, by the originating UE, a Non Access Stratum (NAS) security process with the MME; and

upon completion of the NAS security process with the MME, transmitting, by the originating UE, the data to the MME using an uplink NAS transport message.

2. The method of claim **1**, wherein the service request message comprises information indicating data-sending only, a Key Set Identifier (KSI), and a Message Authentication Code (MAC).

3. The method of claim **2**, wherein the initial UE message comprises the service request message and a temporary identifier which the eNB allocates to identify the originating UE.

4. The method of claim **1**, wherein the initial context setup for signaling message comprises a Key of eNB (KeNB) for setting up the AS security between the eNB and the originating UE and a temporary identifier which the MME temporarily allocates to identify the originating UE in an S1 Application Protocol (AP) connection.

5. The method of claim **1**, wherein the eNB having received the initial context setup for signaling message sets up no data bearer with the originating UE.

6. A system for delivering data in a mobile communication system, system comprising:

an originating User Equipment (UE) configured to send, to an evolved Node-B (eNB), a service request message for requesting data sending in a process of setting up a Radio Resource Control (RRC) connection using a RRC connection complete message;

the eNB configured to send the service request message included in the RRC connection complete message using an initial UE message, if the RRC connection complete message is received when setting up the RRC connection with the originating UE; and

a Mobile Management Entity (MME) configured to send an initial context setup for signaling message that does not include information about data bearers to the eNB, if the initial UE message is received from the eNB,

wherein, if the initial context setup for signaling message is received by the eNB, the eNB sets up Access Stratum (AS) security with the originating UE,

wherein, if the AS security is set up, the originating UE performs a Non Access Stratum (NAS) security process with the MME, and

wherein, upon completion of the NAS security process with the MME, the originating UE sends the data to the MME using an uplink NAS transport message.

7. The system of claim **6**, wherein the service request message comprises information indicating data-sending only, a Key Set Identifier (KSI), and a Message Authentication Code (MAC).

8. The system of claim **7**, wherein the initial UE message comprises the service request message and a temporary identifier which the eNB allocates to identify the originating UE.

9. The system of claim **6**, wherein the initial context setup for signaling message comprises a Key of eNB (KeNB) for setting up the AS security between the eNB and the originating UE and a temporary identifier which the MME temporarily allocates to identify the originating UE in an S1 Application Protocol (AP) connection.

10. The system of claim **6**, wherein the eNB having received the initial context setup for signaling message is further configured to set up no data bearer with the originating UE.

* * * * *